SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANTED

CHOICE BASED CREDIT SYSTEM (CBCS) SEMESTER PATTERN
Post Graduate (PG) Programme in Chemistry
(Affiliated Colleges)
W. E. F. Academic year 2015-16

SYLLABUS FOR M. SC. PART- II
ORGANIC CHEMISTRY

Board of Studies in Chemistry
Swami Ramanand Teerth Marathwada University, Nanded
Choice Based Credit System (CBCS)
Draft Syllabus Prescribed for
M. Sc. Second Year, ORGANIC CHEMISTRY
Semester-III & IV

2. ORGANIC CHEMISTRY (SEMESTER III & IV)

<table>
<thead>
<tr>
<th>Semester</th>
<th>Paper</th>
<th>Course No.</th>
<th>Course</th>
<th>Periods / week</th>
<th>Total Periods</th>
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<tr>
<td>Theory III</td>
<td>XV</td>
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<td>Advanced Spectroscopic Methods</td>
<td>04</td>
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<td>XVI</td>
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Instructions
I] Each Laboratory Course of 6 Hrs duration should be completed in 6 Hrs per day.
II] Assessment shall consist of continuous assessment (CA) and end of Semester examination (ESE).
III] 75% for ESE and 25% for CA.
IV] Paper-(Elective): Transfer of credit as per student choice.
V] Evaluation of Seminar should be from panel of experts.
# Draft Syllabus Prescribed for

## M. Sc. Second Year, ORGANIC CHEMISTRY

### Semester-III & IV

## 2. ORGANIC CHEMISTRY (SEMESTER III & IV)

<table>
<thead>
<tr>
<th>Semester</th>
<th>Paper</th>
<th>Course No.</th>
<th>External (ESE)</th>
<th>Internal (CA)</th>
<th>Total Credits (Marks)</th>
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<td>Theory III</td>
<td>XV</td>
<td>CH-531</td>
<td>75 Marks</td>
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<td>XVI</td>
<td>CH-532/2</td>
<td>75 Marks</td>
<td>2 Tests: 15 marks + Assignment: 10 Marks = 25 marks</td>
<td>04 (100)</td>
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<td>XVII</td>
<td>CH-533/2</td>
<td>75 Marks</td>
<td>2 Tests: 15 marks + Assignment: 10 Marks = 25 marks</td>
<td>04 (100)</td>
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<td>XVIII</td>
<td>CH-534/2</td>
<td>75 Marks</td>
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<td>04 (100)</td>
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<td>XIX</td>
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<td>25 Marks</td>
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| Theory IV | XX | CH-541/2 | 75 Marks | 2 Tests: 15 marks + Assignment: 10 Marks = 25 marks | 04 (100) |
| | XXI | CH-542/2 | 75 Marks | 2 Tests: 15 marks + Assignment: 10 Marks = 25 marks | 04 (100) |
| | XXII | CH-543/2 | 75 Marks | 2 Tests: 15 marks + Assignment: 10 Marks = 25 marks | 04 (100) |
| | XXIII | CH-544/2 | 75 Marks | 2 Tests: 15 marks + Assignment: 10 Marks = 25 marks | 04 (100) |
| | XXIV | | 25 Marks | | 01 |

| Practical III & IV | XXV | CH-501/2 | 75 Marks | 2 Tests: 25 marks | 04 (100) |
| | XXVI | CH-502/2 | 75 Marks | 2 Tests: 25 marks | 04 (100) |
| | XXVII | CH-503/2 | 75 Marks | 2 Tests: 25 marks | 04 (100) |
| | XXVIII | CH-504/2 | 75 Marks | 2 Tests: 25 marks | 04 (100) |

**Total Credits Sem III & IV + Lab Course = 17 + 17 + 16 = 50**
M. Sc. Second Year, Semester-III
Paper–XV, [CH-531]
Advanced Spectroscopic Methods

Credits: 04

Periods: 60

SM-1: UV-Vis Spectroscopy:
SM-2: IR spectroscopy:
SM-3: NMR Spectroscopy (Organic):
SM-4: NMR Spectroscopy (Inorganic):
SM-5: Mass Spectroscopy:
SM-6: Moissabaur Spectroscopy:
SM-7: Structural problems:

SM-1: UV-Vis Spectroscopy:
Fieser-Woodward rules for conjugated dienes and carbonyl compounds, Fieser-Kuhn rules for polyenes. UV spectra of aromatic compounds and heteroaromatic compounds. Calculation of $\lambda_{\text{max}}$ for the benzene derivatives (R-C$_6$H$_r$-Co-G) by A. I. Scott empirical rules.

SM-2: IR spectroscopy:
Inorganic IR spectroscopy: Structural information from vibrational spectra: Group frequencies, Characteristic band stretching frequencies, Mode of vibrations of linear and non-linear molecules, deformation, frequencies of carbonyl metal complexes, pattern of group frequencies, mode of bonding of ambidentate ligands, Cynides, Ethylenediamine and Diketone complexes.

SM-3: NMR Spectroscopy (Organic):

a) $^1$H NMR: General introduction and definitions, Chemical shift, Spin-spin interaction, shielding mechanism of measurement of chemical shift values and correlation for protons bonded to carbon (aliphatic, olefinic, aldehyde and aromatic) and other nuclei (alcohols, phenols, enols, carboxylic acids, amines, amides and mercapto). Factors affecting chemical shift. Deuterium exchange. Spin-spin coupling, factors affecting coupling constant. Complex spin-spin interaction between two and three nuclei. Simplification of complex spectra, nuclear magnetic double resonance, contact shift reagents, solvent effects. Fourier transform technique. Nuclear Over-Hauser effect (NOE). Resonance of other nuclei; $^{19}$F and $^{31}$P.

b) $^{13}$C NMR: Resolution and multiplicity of $^{13}$C NMR, 1H-decoupling, noise decoupling, broad band decoupling; Deuterium, fluorine and phosphorus coupling; NOE signal enhancement, off-resonance, proton decoupling, Structural applications of CMR, DEPT; Introduction to 2D-NMR: COSY, NOESY, DEPT, INPET, APT, INADEQUATE.
SM-4: NMR Spectroscopy (Inorganic): 06P
a) Basic principle of NMR spectroscopy and applications to Paramagnetic compounds and metal nuclei of Pt$^{195}$ and Sn$^{119}$.
b) Basic principle and applications of ESR spectroscopy to different free radical molecules and transition metal ion complexes.

SM-5: Mass Spectroscopy: 08P
Theory, instrumentation and modifications; Unit mass and molecular ions; Important terms- singly and doubly charged ions, metastable peak, base peak, isotropic mass peaks, relative intensity, FTMS, etc.; Recognition of M+ ion peak; General fragmentation rules: Fragmentation of various classes of organic molecules, including compounds containing oxygen, sulphur, nitrogen and halogens; α-, β-, allylic and benzylic cleavage; McLafferty rearrangement.

SM-6: Moissabaur Spectroscopy: 06P
Basic principle of Moissabaur Spectroscopy, applications on the basis of isomer shifts, electric quadrupole interactions. Elucidation of structure of I$_2$Br$_2$Cl$_4$, I$_2$Cl$_6$, Fe$^{+2}$ and Fe$^{+3}$ complexes and Sn$^{+2}$ and Sn$^{+4}$ compounds

SM-7: Structural problems: 10P
a) Combined problems on UV, IR, NMR and Mass spectral data for structure determination.
b) Elucidation of structure of organic molecules using spectra (IR & NMR).

Reference Books:
9. Fundamentals of Molecular spectroscopy – C.N.Banwel
M. Sc. Second Year (Semester-III)
Paper–XVI [CH-532/2]
Natural Products

Credits: 04  Periods: 60

NP-1: Vitamins: 08P
Classification, Occurrence Chemistry of Vitamins A, C and E Structure elucidation and synthesis. Deficiency syndromes etc.

NP-2: Terpenoids and Carotenoids: 12P
Classification, nomenclature, Occurrence, isolation, isoprene rule, structure determination, stereochemistry and biogenesis of the following molecules Citral, Camphor, Menthol, Farnesol, Zingiberene, Abietic acid. Biosynthesis of terpenoids

NP-3: Alkaloids: 08P
Structure, stereochemistry and synthesis of quinine and morphine

NP-4: Steroids: 12P
Occurrence, Nomenclature, Basic Skeleton, Diel’s hydrocarbon and Stereochemistry. Structure determination and synthesis of Cholesterol, Bile acid, Androsterone, Testosterone, Oestrone, Aldosterone and Progesterone.

NP-5: Plant pigments: 10P
Occurrence, nomenclature and general methods of structure determination of Anthocyanidins. Synthesis of Cyanidin Chloride, Chalcones, Flavones, Quercetin.

NP-6: Prostaglandins, pyrethoids, Rotenones and pheromones. 10P
Occurrence, classification. Biogenesis, physiological effects and synthesis of PGE$_2$ and PGF$_{2\alpha}$. Natural and synthetic of pyrethoids, Rotenones and pheromones. Synthesis of bombykol.

Books Suggested:

4. Rodd’s Chemistry of carbon compounds, Ed. S. Coffey.
6. Introduction to Flavonoids, B. A. Bohm.
M. Sc. Second Year, Semester-III  
Paper–XVII; CH-533/2  
Organic Synthesis- I

Credits: 04  
Periods: 60

OS-1: Transformations and Rearrangements:  
OS-2: Selective Organic Reactions:  
OS-3: Oxidation:  
OS-4: Reduction:

OS-1: Transformations and Rearrangements:  
**18P**  
General Mechanistic Consideration, Nature of migration, migratory aptitude, stereochemical aspects and Memory Effects of following rearrangements.  
1.1 Introduction types and classification of rearrangements.  
1.3 Rearrangement to Electron Deficient Nitrogen: Hofman, Curtius, Schimdt, Lossen and Beckmann rearrangements.  
1.4 Rearrangement to Electron Deficient Oxygen: Baeyer-Villiger rearrangement.  
1.5 Rearrangement to Electron Rich Carbon: Fovorskii, Wittig, Neber and Steven’s rearrangements.  
1.6 Aromatic Rearrangement: Fries, Clasisen and Benzidine rearrangement.

OS-2: Selective Organic Reactions:  
**16P**  
Mechanism, Stereochemistry and Synthetic Applications of following reactions.  
2.1 Stork Enamine, Chichibabin, Diels-Alder, Bucherer, Ullmann, Shapiro, Barton, Chugaev, Biginelli, Prins, Hunsdiecker Reactions.  
2.2 Negishi, Suzuki, Buchwald-Hartwig Cross, Stille, Heck chann -Lam coupling reactions.

OS-3: Oxidation:  
**14P**  
Introduction, different oxidative processes.  
3.1 Alcohols to carbonyl compounds: Chromium (VI) oxidants, Dimethyl sulfoxide and its modifications (Swern Oxidation), Mangnese (IV) oxide, Silver carbonate, Hypervalent iodine(III) and (V) reagents ceric ammonium nitrate (CAN).  
3.2 Alkenes to epoxides: Peroxide induced epoxidation-epoxidation by H_{2}O_{2}, hydroperoxides and peroxyacids.  
3.3 Alkenes to diols: oxidation by potassium permanganate, Osmium tetraxoxide and its stereochemical consideration, Prevost oxidation and Woodward modifications.  
3.4 Oxidative cleavage of 1,2-diols: Periodic acid.  
3.5 Oxidation of allylic and benzylic C-H bonds: NBS, DDQ, Chloranil T, SeO_{2}.

OS-4: Reduction:  
**12P**  
Introduction, different reductive processes.  
4.1 Catalytic hydrogenation: Homogenous and heterogeneous catalytic reductions. Dissolving metal reductions including Brich reduction.  
4.2 Non-metallic reductions: Wolff-Kishner and diimide reductions, Hantzsch ester.  
4.3 Metal hydride reductions: Nucleophilic metal hydrides, Sodium cyano borohydride LiAlH_{4}.  
4.4 Electrophilic metal hydrides: BH_{3} and AlH_{3}.  
4.5 Hydrogenolysis: Use of tri-n-butyl tin hydride.
Books Suggested

3. Modern syntetic reactions, H.O.House, W.A.Benjamin
7. Organic Reaction and Their mechanisms, P.S.Kalsi, New Age International Publishers
M. Sc. Second Year, Semester-III
Paper–XVIII; CH-534/2A
Medicinal Chemistry- I

Credits: 04

MC-1: Concepts of Medicinal Chemistry, Classification and Nomenclature of Drugs.

MC-2: Drug Design:

MC-3: Pharmacokinetics and Pharmamodynamics.

MC-4: Drug metabolism.

MC-5: Antimicobacteral drugs.

MC-6: Antibiotics

MC-7: Coagulant and Anticoagulant.

MC-1: Concepts of Medicinal Chemistry, Classification and Nomenclature of Drugs. 06P

A) Concepts of Medicinal chemistry: Important terminology in medicinal chemistry:
Drugs, Pharmacy, Pharmaceutics, Toxicology; Pharmacodynamic agents, Pharmacophore, Pharmacodynamics, metabolite and antimetabolites, chemotherapy.

B) Classification and Nomenclature of Drugs:
  i) Classification of drugs on the basis of therapeutic action.
  a) Chemotherapeutic agents, b) Pharmacodynamic agents.
  ii) Nomenclature of drugs: Naming of drugs according to IUPAC system
  a) Naming of organic groups, b) Naming of heterocyclic nuclei.
  iii) Differentiate medicine and drugs.

MC-2: Drug Design: 18P

A) Drug Discovery.
  i) Introduction
  ii) Procedure followed in drug design.
     a) Drug discovery without a lead, b) Lead discovery.
  iii) Lead modification: Drug design and development
     a) Identification of the active part: The pharmacophore, b) Functional group modification, c) Structure-activity relationship, d) Structure modification to increase potency and the therapeutic index; 1) Homologation, 2) Chain branching, 3) Ring-chain transformation., 4) Bioisosterism, 5) Combinatorial chemistry.
     iv) Structural modification to increase oral bioactivity.
        1) Electronic effect, 2) The Hammet equation, 3) Lipophilicity effect.

B) Concept of prodrugs and soft drugs.
  a) Prodrugs: i) Prodrugs designing, types of prodrugs, ii) Prodrug formation of compounds containing various chemical groups, Prodrugs and drug delivery system
C] Theories of drug activity.
   i) Occupancy theory, ii) Rate theory, iii) Induced theory.

D] QSAR method:

E] Structure based drug design.

   i) Introduction
   ii) Uses of molecular modelling: a) Manual use, b) Further-computer programming,
   c) X-ray crystallography.

G] Design of Enzyme inhibitors.
   i) Introduction, ii) Competitive inhibitors, iii) Active-site directed irreversible inhibition of enzymes, iv) Suicide enzyme inactivation.

H] New developments Gene therapy and drug resistance.

MC-3: Pharmacokinetics and Pharamodynamics. 09P
A] Pharmacokinetics:
   a) Drug absorption, b) Distribution, c) Elimination, d) Disposition

B] Pharmacodynamics.
   a) Introduction, Elementary treatment of enzyme inhibition, b) Membrane active drug, c) Sulphonamides
   Mechanism of action of following drugs:
   Action of CNS disorder, inflammation, cardiac dysfunction.

MC-4: Drug metabolism. 05P

MC-5: Antimicobacterial drugs. 08P
   a) First-line agents (Primary tubercular drugs): Structure and activity of streptomycin and dihydro-streptomycin, Synthesis and SAR of 4-amino salicylic acid and isoniazid.
   (Synthesis of Cycloserine and Ethambutol expected)

B] Antileprotic drugs.
   Chaulmoogra and hydnocarpus oil, Multidrug therapy, SAR of sulphones, Dapsone (DDS), Acedapsone, Solapsone, Diaminodipheyl thiourea, Rifampicin. (Synthesis of Acedapsone expected)

MC-6: Antibiotics. 08P
   1. Introduction, classification of antibiotics, 2. Cell wall synthesis, 3. Mechanism of action of antibiotics, a) Inhibition of cell-wall synthesis, b) Inhibition of bacterial protein synthesis, c) Disorganization of the cytoplasmic membrane, d) Interference in the bacterial nucleic acid synthesis, e) Inhibition of the tetrahydro-folate biosynthesis


MC-7: Coagulant and Anticoagulant. 06P

Suggested Books:
1. Medicinal chemistry-William O. Foye
2. T. B. of Organic medicinal and pharmaceutical chemistry-Wilson and Gisvold’s (Ed. Robert F. Dorge)
3. An introduction to medicinal chemistry-Graham L. Patrick
5. Medicinal chemistry (Vol. I and II)-Burger
6. An introduction to drug design-S. S. Pandeya and J. R. Dimmock (New age international)
8. Strategies for organic drug synthesis and design-D. Lednicer Wiley
9. Pharmacological basis of therapeutics-Goodman and Gilman’s (McGraw Hill)
M. Sc. Second Year, Semester-III
Paper–XVIII; CH-534/2B
Polymer Chemistry – I

Credits: 04                Periods: 60

PC-1: Basics
PC-2: Polymer characterization
PC-3: Structure and properties
PC-4: Polymer processing

PC-1: Basics  12P
Important of polymers, Basic concepts; Monomers, repeat units, degree of polymerization. Linear, branched and network polymers. Classification of polymers. Polymerization: Condensation, addition, radical chain, ionic and co-ordination, and co-polymerization, Polymerization conditions and polymer reactions. Polymerization in homogenous and heterogeneous systems.

PC-2: Polymer characterization  16P

PC-3: Structure and properties  16P
Morphology and order in crystalline polymers configurations of polymer chains. Crystal structures of polymers. Morphology of crystalline polymers. Strain-induced morphology, crystallization and melting. Polymer structure and physical properties – crystalline melting point Tm – melting points of homogenous series, effect of chain flexibility and other steric factors, entropy and heat of fusion. The glass transition temperature. Tg; Relationship between Tm and Tg, effects of molecular weight, diluents, chemical structure, chain topology, branching and cross-linking, property requirements and polymer utilization

PC-4: Polymer processing  16P
Plastics: elastomers and fibres, compounding. Processing techniques: Calendering, die-casting, rotational casting, film casting, injection moulding, blow moulding, extrusion moulding, thermo forming, foaming, reinforcing and fibre spinning.

Books suggested:
1. Text book of Polymer science ; F.w.Billmeyer J.Willey
3. Principles of Polymerization, George Odian III.Ed.
4. Organic Polymer Chemistry, K.J.Saunders
5. Polymer Chemistry, Golding
6. Principles of Polymer Chemistry, Flory
8. Functional monomers and polymers, K.Takemoto, V.Inaki and R.M.Ottanbrite
M. Sc. Second Year, Semester-IV  
Paper-XX; CH-541/2  
Advanced Heterocyclic Chemistry

Credits: 04  
Periods: 60

HC-1: Introduction to Heterocycles  
HC-2: Nonaromatic heterocycles  
HC-3: Five and six-membered heterocycles with two hetero atoms  
HC-4: Heterocycles with more than two hetero atoms.  
HC-5: Larger ring and other heterocycles  
HC-6: Banzanellated azoles and dipolar structures.

HC-1: Introduction to Heterocycles: 06P  
Nomenclature (Hantzsch Widman System), spectral characteristics, reactivity and aromaticity of monocyclic, fused and bridged heterocycles.

HC-2: Nonaromatic heterocycles: 10P  
Different types of strains, interactions and conformational aspects on nonaromatic heterocycles. Synthesis, reactivity, and importance of the following ring systems. Azirines, Oxaranes, Thiiranones, Diazirenes, Diazi ridines, Azetidines.

HC-3: Five and six-membered heterocycles with two hetero atoms: 10P  
Synthesis, reactivity, aromatic character and importance of the following heterocycles: Pyrazole, Imidazole, Oxazole, Thiazole, Pyrimidine, Pyrazine, Oxazine, and Thiazine.

HC-4: Heterocycles with more than two hetero atoms: 10P  
Synthesis, reactivity, aromatic character and importance of the following heterocycles: Triazoles, Oxadia zoles, Thiadia zoles, Triazines.

HC-5: Larger ring and other heterocycles: 12P  

HC-6: Banzanellated azoles and dipolar structures: 12P  

Recommended books:
2. An Introduction to the Chemistry of Heterocyclic compounds, R. M. Acheson.
M. Sc. Second Year, Semester-IV  
Paper-XXI; CH-542/2  
Bio-Organic and Green Chemistry

Credits: 04  
Periods: 60

BOGC-1: Enzyme Chemistry.  
BOGC-2: Nucleic acids.  
BOGC-3: Heterocycles.  
BOGC-4: Introduction to Green Chemistry.  
BOGC-5: Microwave induced and ultrasound assisted green synthesis.  
BOGC-6: Ionic liquids as green solvents and use of biocatalysis.

**BOGC-1: Enzyme chemistry**  
15P  
a] Enzymes: Introduction and historical perspective, chemical and biological catalysis, remarkable properties of enzymes like catalytic power, specificity and regulation. Nomenclature and classification, extraction and purification. Fischer’s lock and key and Koshland’s induced fit hypothesis, concept and identification of active site by the use of inhibitors, affinity labeling and enzyme modification by site-directed mutagenesis. Baker’s yeast catalyzed reactions, Applications of enzymes in food and drug chemistry  
b] Mechanism of Enzyme Action: Transition-state theory, orientation and steric effect, acid-base catalysis, covalent catalysis, strain or distortion. Example of some typical enzyme mechanisms for chymotrypsin, ribonuclease, lysozyme and carboxypeptidase A.  

**BOGC-2: Nucleic acids.**  
10P  
Deoxyribose nucleic acid (DNA): Primary, secondary, tertiary structure of DNA. Structure of RNA. Types of RNA: mRNA, rRNA and tRNA. Purines and pyrimidine bases of nucleic acids and their preparation.  
Lipids: Fatty acids, essential fatty acids, structures and functions of triglycerols, glycerophospho lipids, spingolipids, lipoproteins, composition and function, role in atherosclerosis

**BOGC-3 Heterocycles**  
15P  
A] Azoles: Structural and chemical properties; Synthesis of pyrazole, isothiazole and isoxazole; Synthesis of imidazoles, thiazoles and oxazoles; Nucleophilic and electrophilic substitutions; Ring cleavages.  
B] Benzofused heterocycles: Synthesis of indole, benzofuran and benzo-thiophene, quinoline and isoquinoline Nucleophilic, electrophilic and radical substitutions; Addition reactions; Indole rings in biology.  
C] Diazines: Structural and chemical properties; Synthesis of pyridazines, pyrimidines, pyrazines; Nucleophilic and electrophilic substitutions.

**BOGC-4: Introduction to Green Chemistry.**  
10P  
Introduction, Need for Green Chemistry, Principles, Concept of atom economy and scope. Atom economy in addition, substitution, elimination and rearrangement
reactions. Inception to green chemistry. Introduction to alternative approaches. Green Chemistry in Pharmaceuticals, pesticides, polymers, computer chips etc.
Solvent free reactions-principle, scope, utility of solvent free conditions, controlling solvent free reactions. Phase changes, optimum reaction temperatures, miscibility of reactants and catalysts.
Basic principles of green synthesis. Different approaches to green synthesis-
A) use of green reagents in green synthesis-dimethyl carbonate, polymer supported reagents- peracids, chromic acids.
B) Green catalysts: Acid catalysts, oxidation catalysts, basic catalysts. Applications of zeolites.
C) Phase transfer catalyst in green synthesis: Aliquat 336, benzyltrimethyl ammonium Chloride (TMBA), Tetra-n-butyl ammonium chloride.
D) Advantages of PTC reactions to green synthesis. Applications of PTC’s in Calkylation, n-alkylation, s-alkylation, darzens reaction, Williamsons synthesis and wittig reaction.

**BOGC-5: Microwave induced and ultrasound assisted green synthesis.**

Introduction to synthetic organic transformations under microwave.
a) Microwave assisted reactions in water: Hoffmann elimination, hydrolysis, oxidation, saponification reactions.
b) Microwave assisted reactions in organic solvents: Esterification reactions, Fries rearrangement, Orthoester Claisen rearrangement, Diels-Alder reaction, decarboxylation.
c) Microwave solvent free reactions (Solid state reactions): Deacetylation, deprotaction, saponification of ester, alkylation of reactive methylene compounds, synthesis of nitriles from aldehydes, reductions.
d) Ultrasound assisted reactions: Introduction, substitution reactions, addition, oxidation, reduction reactions.

**BOGC-6: Ionic liquids as green solvents and use of biocatalysis.**
a) Ionic liquids as green solvents-green solvents, reactions in acidic ionic liquids and in neutral ionic liquids (Hydrogenation, Diels-Alder reaction, O-alkylation and Nalkylation).
b) Biocatalysts in organic synthesis: Introduction, i) Biochemical Oxidation and reduction (microbial)-production of fine chemicals, vitamins and amino acids. II) by microorganisms-production of penicillins, streptomycin and chloremphenicol.

**Books Suggested:**
7. Organic Synthesis: Special techniques, V. K. Ahluwalia and Renu Aggarwal
10. Enzyme Structure and Mechanism, A. Fersht, W. H. Freeman
13. Advanced organic chemistry by – Carry and Sundberg
Credits: 04  Periods: 60

OS-1: Organic Reagents:
OS-2: Reterosynthetic Analysis-I:
OS-3: Reterosynthetic Analysis-II:
OS-4: Designing Organic Synthesis:

OS-1: Organic reagents: 18P
1.1 Organo metallic Reagents.
   Principle, preparation, properties and applications of the following in organic synthesis with mechanistic details: Gilman’s Reagent (Lithium Dimethyl cuprate), Organocerium Reagents, Organochromium Reagents, Organosilicon Reagents.
1.2 Organo nonmetallic Reagents.
   Principle, preparation, properties and applications of the following in organic synthesis with mechanistic details: Lithium Diisoproplamide, Trimethylsilyl iodide, Diazomethane, Polyphosphoric acid, Dicyclohexylcarbodiimide, Lead Tetra-acetate, Borane.

OS-2: Reterosynthetic Analysis-I: 14P
2.1 Disconnection Approach: An introduction to synthons and synthetic equivalents, donar and acceptor synthons, disconnection, steps in planning the synthesis, alternating polarity disconnection, functional group interconversions, the importance of the order of events in organic synthesis, chemoselectivity, regioselectivity, Umpolung concept.
2.2 The concept of protecting functional groups and synthesis.
   Protection of Amino, Hydroxy, Diol, Carbonyl group of aldehydes and ketones, double and triple bonds

OS-3: Reterosynthetic Analysis-II: 14P
3.1 One group C-X and two group C-X disconnection
3.2 One group Carbon-Carbon Disconnections: Alcohols, and Carbonyl compounds, Alkene synthesis, use of acetylene and aliphatic nitro compounds in organic synthesis.
3.3 Two Group carbon-carbon Disconnections: Diels-Alder reaction 1,3-functionalised compounds, α β unsaturated carbonyl compounds, Control of relative stereochemistry, Control of enatioselectivity control in carbonyl condensations, 1-5 disfunctionalised compounds, Michael addition and Robinson annulations.

OS-4: Designing Organic Synthesis: 14P
4.1 Rearrangement in synthesis.
4.2 Use of ketene in Synthesis.
4.3 Aromatic heterocycles five member rings.
4.4 Synthesis of five and six member rings.
4.5 Synthesis of complex molecules: Camphor, reserpine and vitamin D₂.
Books Suggested

3. Modern syntetic reactions, H.O.House, W.A.Benjamin
M. Sc. Second Year, Semester-IV  
Paper XXIII, CH-544/2A  
Medicinal Chemistry- II

Credits: 04

Periods: 60

MC-1: Anti-cancer and Anti-AIDS agents.
MC-3: Antimalarials.
MC-4: Analgesic and Anti-inflammatory drugs:
MC-5: Drugs acting on CNS:
MC-6: Intellectual property right (IPR):

MC-1: Anti-cancer and Anti-AIDS agents.  

B] Anti-AIDS agents: 
Introduction, structure and life cycle of the AIDS virus, recent development, Taxol and Azedothydidine (AZT) derivatives.

Introduction, Types of diabetics, Insulin and its preparation, Storage, secretion, and function of insulin, SAR and mechanism action of Sulphonyl urea and Biguanides, Sweeting agents: Saccharin and p-Phenyl urea (Dulcin), (Synthesis of sodium saccharin expected).

B] Cardiac drugs: 

MC-3: Antimalarials.  
-Introduction, life cycle of plasmodia, chemotherapy of malaria, types of antimalarial drugs. SAR of 8-aminoquinoline derivatives, 4-aminoquinoline derivatives, pyrimidine and biguanide derivatives. Synthesis of pamaquine, primaquine, santouquine, camaquine, and pyrimethamine and choroquine phosphate (expected).
MC-4: **Analgesic and Anti-inflammatory drugs:**

I] Analgesics:
   i) Derivatives of Aniline: Synthesis of antifebrin, exalgin and Euparin
   ii) Quinoline derivatives: SAR of cinchophen, morphine and related compounds.
   iii) SAR of piperidine, meperidin, methadone, and 6, 7-benzomorphans
   iv) Synthesis of mepiridine, methadone and 6, 7-benzomorphans (expected)

II] Anti-inflammatory drugs:
- Introduction, classification on non-steroidal anti-inflammatory drugs, SAR of methyl salicylate, aspirin, iodomethazine, mafenamic acid, phenyl butazone, oxphenbutazone, Synthesis of ibuprofen and phenylbutazone.

III] Treatment of Gout:
- Introduction, synthesis and uses of Allopurinol.

B] Antifungal agents.
- Introduction, synthesis of Econazole and Fluconazole.

MC-5: **Drugs acting on CNS:**

A] Anaesthetics:
   ii) Local anaesthetics: Introduction, development of local anaesthetics, classification (according to chemical structure), a) Cocaine and its analogues, b) Procaine and related amino benzoic acid, c) Stovain and its analogues, d) Lidocaine and its analogues, e) Synthesis and SAR of cocaine, procaine, lidocaine and stovaine

B] Depressants:
- Introduction
   i) Sedative and hypnotics, SAR of aldehydes, ketones and sulphones

C] Antipsychotic agents (Neuroleptic agents): Selective modifier of CNS (Tranquillizers)
- Introduction, Classification
   i) Phenothiazine and thioxanthene derivatives: SAR of promazine, chloropromazine and related compounds.
   ii) Butyrophenones derivatives: Synthesis of haloperidol, spiroperidol. SAR of butyrophenones derivatives
   iii) Central nervous system stimulants (Antidepressants): Introduction
   Tricyclic system with central seven membered ring: Dibenepine and related compounds, SAR of dibenzepine derivatives
   Synthesis of imipramine, amitriptyline, Chloropromazine and Diazepam.

MC-6: A] Intellectual property right (IPR):


B] Agents for organ imagine OR Diagnostic agents.
- Introduction, Classification, Radiopagues agents (contrast media), Water soluble and Water insoluble contrast media. Synthesis of Metrizamide, Iopanoic acid and Pyroplidone. Diagnostic chemicals: i) Drugs used to test kidney functions, ii) Drugs
used to test liver functions, iii) Agents used to test gastric function, iv) Agents used to test cardiac function, v) Miscellaneous diagnostic chemicals.

C) Drug acting on Gastrointestinal tract (Drug acting on GIT).

Introduction
a) Gastric antacid: i) Treatment of gastric hyperacidity, ii) H₂-receptor antagonists-Synthesis of Ranitidine (Zantac) and Famotidine. b) Ulcerative colitis.
c) Antispasmodics agents (Spasmolytic agents), d) Anthelmintic agents: Introduction, anthelmintic agents, synthesis of mebendazole.

Suggested Books:
1. Medicinal chemistry-William O. Foye
2. T. B. of Organic medicinal and pharmaceutical chemistry-Wilson and Gisvold’s (Ed. Robert F. Dorge)
3. An introduction to medicinal chemistry-Graham L. Patrick
5. Medicinal chemistry (Vol. I and II)-Burger
6. An introduction to drug design-S. S. Pandeya and J. R. Dimmock (New age international)
8. Strategies for organic drug synthesis and design-D. Lednicer Wiley
9. Pharmacological basis of therapeutics-Goodman and Gilman’s (McGraw Hill)
M. Sc. Second Year, Semester-IV  
Paper-XXIII, CH-544/2B  
Polymer Chemistry – II

Credits: 04  
Periods: 60

PC-1: Properties of commercial polymers
PC-2: Polymer Additives
PC-3: Natural polymers
PC-4: Polymer supported reagents in organic chemistry
PC-5: Polymer Degradation and Stabilization

PC-1: Properties of commercial polymers  
Polyethylene, polyvinyl chloride, polyamides, polyesters, phenolic resins, epoxy resins and silicone polymers. Functional polymers – Fire retarding polymers and electrically conducting polymers, Bio-medical polymers – contact lens, dental polymers, artificial heart, kidney, skin and blood cells

PC-2: Polymer Additives  
Role of additives in polymers, Fillers, plasticizers, anti-oxidants and stabilizers, Flame-retardants, colourants.

PC-3: Natural polymers  
Cellulose: Cellulose nitrate, cellulose acetate. viscose rayon, starch, silk, Rubber and modified rubber.

PC-4: Polymer supported reagents in organic chemistry  
Preparation and application of polymer supported catalysts, acids, bases, phase transfer catalysts, transition metal complexes etc. Polymer supported reagents and polymer supported protecting groups including “Solid Phase” peptide synthesis.

PC-5: Polymer Degradation and Stabilization  
Types of degradation – Physical and chemical degradation.  
Types of Physical degradation  
a. Thermal degradation  
b. Photodegradation and stabilization  
c. Mechanical degradation.  
Types of Chemical degradation  
a. Solvolytic degradation  
b. hydrolytical degradation  
c. Oxidative degradation and stabilization  
d. biodegradation.

Books Suggested:
1. Text book of Polymer science ; F.w.Billmeyer J.Willey
2. Polymer science, V.R.Gowarikar, N.V.Vishwanathan and J.Sreedhar, Wiley Eastern
3. Principles of Polymerization, George Odian III.Ed.
4. Organic Polymer Chemistry, K.J.Saunders
5. Polymer Chemistry, Golding
6. Principles of Polymer Chemistry, Flory
8. Functional monomers and polymers, K.Takemoto, V.Inaki and R.M.Ottanbrite
Qualitative Analysis (At least 10 Organic Mixtures):

Semi-micro Qualitative Analysis of Ternary Mixtures (Solids; Two Solids and One Liquid, One Solid and Two Liquids) containing single/poly functional compounds by Chemical and Physical Method with Chromatographic Separation (TLC) for purity of all three components and its Expected Theoretical Spectral Data (IR, $^1$H NMR & $^{13}$C NMR).
M. Sc. Second Year
Laboratory Course-VI, Paper- XXVI, CH-502
Synthesis of Organic Molecules

Credits: 04

1. **Multistage Synthesis (At least four)**
   a) Benzophenone → benzopinacol → benzopinacolone
   b) Benzoin → benzil → benzilic acid
   c) Benzaldehyde → chalcone → chalcone epoxide,
   d) Acetanalide → 4-bromoacetanalide → 4-bromo-2-chloroacetanalide → 2-chloro-4-bromoaniline.
   e) Cyclohexanone → cyclohexanone oxime → caprolactone
   f) Anthranilic acid → o-chlorobenzoic acid → N-phenyl Anthranilic acid → acridone

2. **Synthesis of Drug Molecules (At least Four)**
   a) Synthesis of anaesthetic drug Benzocaine.
   b) Synthesis of anticancer drug 6-methyl uracil.
   c) Synthesis of antibacterial drug sulfanilamide.
   d) Synthesis of anti-epileptic drug antypyrine.
   e) Synthesis of anti-convulsant drug Phenytoin.

3. **Use of ultrasound and microwaves in organic synthesis. (One Each)**
   a) Ultrasound-assisted one-pot synthesis of 2,4,5-triarylimidazole catalyzed by ceric (IV) ammonium nitrate in aqueous media from benzaldehyde, benzil/benzoin and ammonium acetate. (Chinese Chemical Letter, 20 (3), 283-287, 2009).
   c) The Hantzch dihydropyridine synthesis from aldehydes, ethyl acetoacetate and urea in microwave irradiation. (Synthetic Letters, 8, 1296-1298, 2001; Synthetic Communications, 31, 425-430, 2001)
   e) Synthesis of dihydropyrimidones from Biginelli Reaction by acid-catalyzed, three-component reaction between an aldehyde, β-ketoester and urea (Tetrahedron, 2005, 61, 4275-4280).  

**Note:**
1. Synthesis is carried out in molar quantities (Less than 5 gm).
2. Reaction with possible mechanism.
3. Calculate Theoretical and practical % yield.
4. Product conformation by Physical constant and TLC.
5. Give expected spectral data (IR and NMR) of starting material, intermediate and final product.
6. All the prepared organic compounds should be stored as a sample and present at the time of University examination.
M. Sc. Second Year  
Laboratory Course-VII, Paper– XXVII, CH-503  
Physico-Organic Estimations  

Credits: 04  
Periods: 132  

A]  Estimation of Drugs by Titrimetry: (At least three)  
   a) Assay of Aspirin.  
   b) Assay of Ibuprofen.  
   c) Assay of Analgin.  
   d) Determination of Chloride in Ringer Lactate solution for Injection.  
   e) Determination of Calcium ions in Calcium Gluconate Injection.  

B]  Isolation of natural products. (At least three)  
   a) Isolation of caffeine from tea leaves.  
   b) Isolation of piperine from black pepper  
   c) Isolation of β-carotene from carrots  
   d) Isolation of lycopene from tomatoes  
   e) Isolation of limonene from lemon peel  
   f) Isolation of eugenol from cloves  

C]  Estimation of Drugs by Instrumental Methods: (At least Four)  
   a) Assay of sulfanilamide by Potentiometry.  
   b) Assay of Riboflavin by Colorimetry.  
   c) Assay of ascorbic acid by Colorimetry.  
   d) Assay of Diazepam by UV-Vis Spectrophotometer.  
   e) Assay of Riboflavin by UV-Vis Spectrophotometer.  
   f) Estimation of carbohydrates, amino acids, proteins by UV-Vis spectrophotometer.  
   g) Determination of Hammett constants and determine its substitution effect.  
      i) Benzoic acid, ii) P-Nitro Benzoic acid, iii) P-Methoxy Benzoic acid, iv) P-Methyl benzoic acid, v) P-Chloro benzoic acid.  
      (Out of two compounds one compound must be benzoic acid and another should be substituted benzoic acid is given to the students)  

Note:  
1. All required solutions must be prepared by the students.  
2. In examination one experiment is on Instrumental and one should be on non-instrumental.  

Books Referred:  
2. Advanced practical organic chemistry by N.K.Vishnoi  
4. The systematic identification os organic compounds by R.L.Shriner & D.Y.Curtin  
5. Semi-microqualitative organic analysis by N.D.Cheronis, J.B.Entrikin & E.M.Wodnett  
6. small scale organic preparation by P.J.Hill  
M. Sc. Second Year
Laboratory Course-VIII, Paper– XXVIII, CH-504
Project

Credits: 04 (Project: 75 + Seminar 25)  Periods: 132

Literature Survey, Studies of Reactions, Synthesis, Mechanism, Isolation of Natural
Products, Standardization of Reaction Conditions, New Synthetic Methods etc.

Note:
1. External and Internal Examiners will examine this project jointly at the time of
   Practical examination.
2. The students will have to give at least one seminar in each semester in their subject of
   specialization is compulsory.
3. Project work must be carried out only in specialized branch.
4. All synthesized organic compounds should be submitted at the time of University
   Examination.
5. The project work carried out during the year should be presented in power point
   presentation in presence of University Examiners.
CHOICE BASED CREDIT SYSTEM (CBCS)
SEMESTER PATTERN
Post Graduate (PG) Programme in Chemistry
(Affiliated Colleges)
w. e. f. Academic year 2015-16
Question paper Model
(For all papers)

Mark: 75
Time: 3 hrs

Q 1. Solve any three out of five. Marks – 15
(a)
(b)
(c)
(d)
(e)

Q 2. Attempt any three out of five. Marks – 15
(a)
(b)
(c)
(d)
(e)

Q 3. Solve. (A)
OR (A) Marks – 08
(B)
OR (B) Marks – 07

Q 4. Solve. (A)
OR (A) Marks – 08
(B)
OR (B) Marks – 07

Q 5. (A) Select the correct alternative from the following – Marks - 5
(B) Write short notes on any two – Marks - 10
(a)
(b)
(c)